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Notes.

No. 1 is attended by a star of mag. 14, a trifle south, and by another, which follows the nebula closely.

No. 2 is accompanied by a star of mag. 13, a trifle south preceding. The nebula is about 3′ from 530, which is identical with (106), the position of 530 in the N.G.C. being slightly erroneous. According to my measures, the position of 530 is $1^h\ 19^m\ 36^s - 2^\circ\ 6'.5$; this agrees with Bigourdan's place for (106). No. 4 should perhaps be reckoned as identical with 690, though the N.G.C. place of the latter is $1^h\ 44^m\ 31^s - 17^\circ\ 14'.0$ when reduced to 1900·0. However, Leavenworth's declinations are not apt to be so erroneous as would be the case if No. 4 were identical with 690. No. 6 is a star of mag. 11, with very slight outlying nebulosity.

No. 7 is equivalent in brightness to a star of mag. 13.

No. 10 is accompanied by a star of mag. 9 which follows eight seconds at the same declination.

No. 19 is near (847); 4973 and 4974, according to the N.G.C., follow No. 19 less than a minute of time; but their relative positions are not the same as those of (847) and No. 19. I looked for them on one night, when the seeing was poor, and could not be sure of them.

No. 22 precedes a star of mag. 9·5 thirteen seconds, 0′·2 north.

No. 24 looks like a star of mag. 13, blurred atmospherically. Other faint nebulæ are suspected in its vicinity.

No. 15 of the list in *M.N.* lviii. 9, has now been measured micrometrically, and its position is $12^h\ 45^m\ 43^s - 13^\circ\ 57'.1$.

A nebula is suspected 5′ south of 4862. Two or three very faint nebulæ are suspected near 5664.

Ephemeris of Eros. By Frank Robbins.

In the *Astronomical Journal* (Vol. xix. No. 19, 451, 1898, December 12, page 155), Dr. S. C. Chandler, of Cambridge, U.S.A., has given the orbital elements upon which is founded the ephemeris now offered to the Royal Astronomical Society.

Dr. Chandler's elements were derived from the discussion of 142 observations, both visual and photographic, made at Berlin, Mount Hamilton, Washington, Harvard, and elsewhere, by the discoverer, De Witt, and by various observers, including Hussey, Frisby, Wendell, Barnard, and others, between 1898 August 17, and 1898 November 26, a comparatively short period with but few observations. Nevertheless the places derived from photographic observations made at Arequipa as long ago as 1893 December 19 (*Astronomical Journal*, Vol. xix. No. 19, 452, page 161), are not so very far from the computed places.

Knowing this when commencing this calculation in 1899 May, I did not try to improve the elements in any respect. In the time at my disposal it would have been impossible to extend the range of observations, confessedly somewhat limited, with a view

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to the deduction of more accurate elements. To compute the perturbations produced by five planets during a period of 1116 (31 × 36) days and to obtain new elements for every thirty-sixth day is a heavy task when undertaken single-handed, nor is the work by any means concluded by the production of new orbital elements for the date of opposition. The prediction of heliocentric places at three-day intervals, and geocentric places for each noon and each transit involves much labour. For the perturbations produced by *Venus*, the Earth, *Mars*, *Jupiter*, and *Saturn*, I have employed the method of variation of constants as set forth in a paper (a perfect model for clearness and fulness of detail) by the late Astronomer Royal as an appendix to the *Nautical Almanac* for 1837, and illustrated by Woolhouse in the case of Halley's comet in the appendix for 1839.

This method does not lend itself to tabulation, and in consequence is somewhat laborious; however, it is not without its advantages. Using the method and the arrangement of formulæ employed at the *Nautical Almanac* office it was natural to adopt the data used there at the present time, in particular the following values of perturbing masses :—

log mass	*Venus*	4·39595
„	Earth	4·48395
„	*Mars*	3·50955
„	*Jupiter*	6·97969
„	*Saturn*	6·45573

In the actual calculations every effort has been made to secure accuracy, to which end the perturbations were calculated independently in duplicate by the writer and by Mr. J. Abner Sprigge of the *Nautical Almanac* office, while the heliocentric and geocentric places were carefully examined and differenced by the latter to the fourth, fifth, and sometimes even to the sixth order.

The opposition in right ascension occurs on October 30·41, and in longitude on November 11·04. The planet retrogrades in longitude from October 16 to December 15, and in right ascension from October 3 to December 5, and during the period covered by the ephemeris circles round γ *Andromedæ* at a distance of a few degrees. The greatest heliocentric latitude, 10° 50′·15 N., occurs on October 19, and the greatest geocentric latitude, 39° 38′·0 N., occurs on November 18. The planet is in perigee on December 26 at a distance 0·315.

The next opposition is in 1903 February. If this ephemeris appears to supply a need I may possibly calculate a similar ephemeris for that date, but in view of the number of astronomers who appear to be at work on this subject, I fear there is some danger of duplication.

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I append the elements, &c., for mean equinox of 1900 November 1·5:—

ϵ	66° 9′ 4′·2
π	121 11 21·4
ν	303 33 18·5
ι	10 50 16·5
ϕ	12 52 38·3
log a	0·1637863
n	2015″·2423
e	0·2228644.

Eros at Transit at Greenwich.

1900.	Apparent Right Ascension. h m s	Var. of R.A. in 1 hour of long. s	Apparent Declination. ° ′ ″	Var. of Dec. in 1 hour of long. ″	Mag.	Hor. Par. ″
Sept. 19	2 39 3·37	+1·68	N. 40 28 23·5	+57·1	10·9	13·3
20	2 39 42·32	+1·57	N. 40 51 14·3	+57·1	10·9	13·4
21	2 40 18·84	+1·47	N. 41 14 5·3	+57·1	10·9	13·6
22	2 40 52·85	+1·36	N. 41 36 56·1	+57·1	10·8	13·8
23	2 41 24·31	+1·26	N. 41 59 46·5	+57·1	10·8	13·9
24	2 41 53·09	+1·14	N. 42 22 35·7	+57·0	10·8	14·1
25	2 42 19·12	+1·02	N. 42 45 23·0	+57·0	10·7	14·3
26	2 42 42·29	+0·90	N. 43 8 8·0	+56·9	10·7	14·4
27	2 43 2·53	+0·78	N. 43 30 50·0	+56·7	10·7	14·6
28	2 43 19·75	+0·65	N. 43 53 28·0	+56·5	10·6	14·8
29	2 43 33·88	+0·52	N. 44 16 1·4	+56·3	10·6	14·9
30	2 43 44·82	+0·39	N. 44 38 29·7	+56·1	10·6	15·1
Oct. 1	2 43 52·51	+0·25	N. 45 0 52·2	+55·8	10·5	15·3
2	2 43 56·86	+0·11	N. 45 23 8·1	+55·5	10·5	15·5
3	2 43 57·79	−0·03	N. 45 45 16·6	+55·2	10·5	15·7
4	2 43 55·20	−0·18	N. 46 7 16·3	+54·8	10·4	15·9
5	2 43 49·02	−0·33	N. 46 29 6·2	+54·4	10·4	16·1
6	2 43 39·17	−0·49	N. 46 50 45·8	+53·9	10·4	16·3
7	2 43 25·52	−0·65	N. 47 12 14·0	+53·4	10·3	16·5
8	2 43 7·98	−0·81	N. 47 33 29·6	+52·9	10·3	16·7
9	2 42 46·42	−0·98	N. 47 54 31·5	+52·3	10·3	16·9
10	2 42 20·75	−1·16	N. 48 15 18·4	+51·6	10·2	17·1
11	2 41 50·92	−1·33	N. 48 35 49·2	+50·9	10·2	17·3
12	2 41 16·85	−1·51	N. 48 56 0·8	+50·1	10·2	17·5
13	2 40 38·47	−1·69	N. 49 15 51·9	+49·2	10·2	17·7

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1900.		Apparent Right Ascension. h m s	Var. of R.A. in 1 hour of long. s	Apparent Declination. ° ′ ″	Var. of Decl. in 1 hour of long. ″	Mag.	Hor. Par. ″
Oct.	14	2 39 55·72	−1·87	N. 49 35 20·1	+48·2	10·2	17·9
	15	2 39 8·53	−2·06	N. 49 54 24·7	+47·2	10·1	18·1
	16	2 38 16·88	−2·25	N. 50 13 4·5	+46·1	10·1	18·3
	17	2 37 20·70	−2·44	N. 50 31 18·4	+45·0	10·1	18·6
	18	2 36 19·93	−2·63	N. 50 49 5·7	+43·9	10·1	18·8
	19	2 35 14·57	−2·82	N. 51 6 24·6	+42·7	10·0	18·9
	20	2 34 4·60	−3·01	N. 51 23 14·1	+41·4	10·0	19·1
	21	2 32 50·12	−3·19	N. 51 39 31·3	+40·0	10·0	19·3
	22	2 31 31·21	−3·38	N. 51 55 13·5	+38·5	9·9	19·5
	23	2 30 8·01	−3·56	N. 52 10 17·9	+36·8	9·9	19·7
	24	2 28 40·59	−3·73	N. 52 24 41·6	+35·1	9·9	20·0
	25	2 27 9·11	−3·89	N. 52 38 22·6	+33·3	9·8	20·2
	26	2 25 33·73	−4·05	N. 52 51 18·2	+31·4	9·8	20·4
	27	2 23 54·61	−4·20	N. 53 3 27·7	+29·5	9·8	20·6
	28	2 22 11·94	−4·35	N. 53 14 50·4	+27·5	9·7	20·8
	29	2 20 25·94	−4·48	N. 53 25 25·6	+25·4	9·7	21·0
	30	2 18 36·85	−4·60	N. 53 35 10·7	+23·3	9·7	21·2
	31	2 16 44·92	−4·71	N. 53 44 4·4	+21·1	9·6	21·4
Nov.	1	2 14 50·45	−4·82	N. 53 52 5·2	+18·9	9·6	21·6
	2	2 12 53·71	−4·91	N. 53 59 11·6	+16·6	9·6	21·8
	3	2 10 55·03	−4·98	N. 54 5 22·7	+14·3	9·6	22·0
	4	2 8 54·74	−5·04	N. 54 10 36·7	+11·9	9·6	22·2
	5	2 6 53·15	−5·09	N. 54 14 53·1	+ 9·5	9·5	22·4
	6	2 5 50·58	−5·12	N. 54 18 11·0	+ 7·0	9·5	22·6
	7	2 2 47·41	−5·14	N. 54 20 28·8	+ 4·5	9·5	22·8
	8	2 0 44·01	−5·14	N. 54 21 46·6	+ 2·0	9·5	23·0
	9	1 58 40·74	−5·12	N. 54 22 3·8	− 0·6	9·4	23·2
	10	1 56 38·00	−5·09	N. 54 21 19·6	− 3·1	9·4	23·4
	11	1 54 36·23	−5·04	N. 54 19 33·8	− 5·7	9·4	23·6
	12	1 52 35·85	−4·98	N. 54 16 46·0	− 8·3	9·3	23·8
	13	1 50 37·29	−4·89	N. 54 12 56·5	−10·9	9·3	24·0
	14	1 48 40·96	−4·79	N. 54 8 5·3	−13·4	9·3	24·2
	15	1 46 47·26	−4·67	N. 54 2 13·0	−16·0	9·3	24·3
	16	1 44 56·60	−4·54	N. 53 55 19·9	−18·5	9·3	24·5
	17	1 43 9·37	−4·39	N. 53 47 27·3	−20·9	9·2	24·7
	18	1 41 25·94	−4·22	N. 53 38 36·0	−23·3	9·2	24·8
	19	1 39 46·68	−4·04	N. 53 28 47·0	−25·7	9·2	25·0
	20	1 38 11·94	−3·85	N. 53 18 1·5	−28·0	9·2	25·2

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1900.		Apparent Right Ascension.	Var. of R.A. in 1 hour of long.	Apparent Declination.	Var. of Dec. in 1 hour of long.	Mag.	Hor. Par.
		h m s	s	° ′ ″	″		″
Nov.	21	1 36 42·06	−3·64	N. 53 6 21·1	−30·3	9·2	25·3
	22	1 35 17·37	−3·42	N. 52 53 47·2	−32·5	9·2	25·4
	23	1 33 58·13	−3·19	N. 52 40 21·5	−34·6	9·1	25·6
	24	1 32 44·61	−2·94	N. 52 26 6·3	−36·6	9·1	25·7
	25	1 31 37·01	−2·69	N. 52 11 3·2	−38·5	9·1	25·8
	26	1 30 35·55	−2·43	N. 51 55 14·3	−40·4	9·1	26·0
	27	1 29 40·40	−2·16	N. 51 38 41·9	−42·2	9·1	26·1
	28	1 28 51·69	−1·89	N. 51 21 28·2	−43·9	9·1	26·2
	29	1 28 9·55	−1·62	N. 51 3 35·0	−45·5	9·0	26·4
	30	1 27 34·04	−1·34	N. 50 45 4·6	−47·0	9·0	26·5
Dec.	1	1 27 5·21	−1·06	N. 50 25 58·5	−48·4	9·0	26·6
	2	1 26 43·09	−0·78	N. 50 6 18·8	−49·8	9·0	26·7
	3	1 26 27·71	−0·50	N. 49 46 7·3	−51·1	9·0	26·8
	4	1 26 19·02	−0·22	N. 49 25 25·8	−52·3	9·0	26·9
	5	1 26 17·03	+0·06	N. 49 4 16·1	−53·4	8·9	27·0
	6	1 26 21·67	+0·33	N. 48 42 40·1	−54·5	8·9	27·1
	7	1 26 32·92	+0·61	N. 48 20 39·1	−55·5	8·9	27·2
	8	1 26 50·73	+0·88	N. 47 58 14·9	−56·5	8·9	27·3
	9	1 27 15·03	+1·15	N. 47 35 29·1	−57·3	8·9	27·3
	10	1 27 45·79	+1·41	N. 47 12 23·0	−58·1	8·9	27·4
	11	1 28 22·94	+1·68	N. 46 48 58·1	−58·9	8·9	27·4
	12	1 29 6·42	+1·94	N. 46 25 16·1	−59·6	8·9	27·5
	13	1 29 56·16	+2·20	N. 46 1 18·0	−60·2	8·9	27·5
	14	1 30 52·07	+2·46	N. 45 37 5·2	−60·8	8·9	27·6
	15	1 31 54·08	+2·71	N. 45 12 38·7	−61·4	8·9	27·6
	16	1 33 2·11	+2·96	N. 44 47 59·5	−61·9	8·9	27·7
	17	1 34 16·04	+3·20	N. 44 23 9·4	−62·3	8·8	27·7
	18	1 35 35·77	+3·44	N. 43 58 9·9	−62·6	8·8	27·8
	19	1 37 1·18	+3·68	N. 43 33 2·4	−63·0	8·8	27·8
	20	1 38 32·18	+3·91	N. 43 7 47·5	−63·3	8·8	27·8
	21	1 40 8·62	+4·13	N. 42 42 25·9	−63·6	8·8	27·8
	22	1 41 50·41	+4·35	N. 42 16 57·9	−63·8	8·8	27·8
	23	1 43 37·46	+4·57	N. 41 51 25·7	−63·9	8·8	27·9
	24	1 45 29·68	+4·78	N. 41 25 49·7	−64·0	8·8	27·9
	25	1 47 26·93	+4·99	N. 41 0 11·7	−64·1	8·8	27·9
	26	1 49 29·11	+5·19	N. 40 34 31·4	−64·2	8·8	27·9

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Note on the accuracy of the Star Charts published by the French Observatories as reproductions of their Plates for the Astrographic Chart. By H. H. Turner, M.A., F.R.S., Savilian Professor.

1. The French observatories which are taking a share in the International Astrographic Chart (Paris, Algiers, Bordeaux, Toulouse)* have already published a number of large paper sheets, reproducing by heliogravure the long-exposure plates on a scale of 2^{mm} to $1'$ (twice that of the original negatives). These reproductions are very beautiful, but apparently somewhat expensive. From figures mentioned at the meeting of the Permanent Committee last July, it would seem that it would cost each observatory about 10,000*l.* to reproduce their plates in this way. Now some of the participating observatories will not find it easy to obtain a sum of this kind for the work; and it becomes important to know what we may expect in return, and especially what is the order of accuracy of these maps. We have not been hitherto accustomed to associate any very great accuracy with paper star maps. They represent well enough the general configurations of the stars, but have not been intended for exact measurement. The charts of *Argelander* and *Chacornac*, for instance, do not always give the places correctly to $1'$; a case has been quoted (see *Mem. R. A. S.*, vol. lii., p. 184) where one of the latter is in error for $3'$ or $4'$ over a sensible area. No such errors are likely to occur in photographic reproductions, but very little has been published to show what accuracy can be obtained from paper prints. Five years ago I showed that a very considerable accuracy was attainable in contact prints (*Monthly Notices*, vol. lvi., p. 26); and in this paper it was stated that the images on the prints, especially of the réseau-lines, were rather diffuse, so that better results might be expected when attention was paid to securing better images.

2. No opportunity for continuing the investigation has presented itself until recently, when a portion of one of the beautiful reproductions of the Paris Observatory was examined. These measures are not sufficiently extended to settle the question of accuracy completely, but may serve to draw attention to the need for settling it. They seem to indicate that *we can get star-places from these paper charts at least as good as those obtained with meridian instruments.* On finding this result, I wrote to M. Loewy and M. Trépied, suggesting that a much more complete investigation could be made by comparing measures of these paper reproductions with measures of the original negatives; and a courteous reply was at once received, saying that the investigation should be undertaken. At the same time a wish was

* We have also recently received two sheets of the same kind from the San Fernando Observatory.

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expressed that these measures should be published. They have the incompleteness and roughness of a preliminary investigation, but the necessity of attending to the Opposition of *Eros* prevents the thorough revision that might otherwise be given to them; and they will at least serve the purpose, as remarked above, of drawing attention to an important matter.

3. The whole of the work was done by Mr. F. C. H. Carpenter, Assistant at the Durham Observatory. Mr. Carpenter was for some years at the University Observatory, Oxford, which he left for his appointment at Durham, and during a recent holiday visit to Oxford he requested permission to measure and reduce a few plates as in the old days (a request which was naturally gratifying, as showing that such work is not irksome), and I suggested that, instead of measuring one of the regular plates of our zone, he should make some measures on one of the Paris charts in zone $+24°$, which overlaps our zone $+25°$, and compare them with measures on an Oxford plate, in order to test the accuracy of the paper charts. He willingly assented, and what follows is the result of his work.

4. The Paris chart selected had centre at $+24°$, $20^h\ 40^m$, and the Oxford plate $+25°$, $20^h\ 44^m$. The quarter-plate of the paper chart overlapping the Oxford plate was carefully cut out along the bounding réseau-lines, and placed between two pieces of plate-glass. Being on twice the linear scale, the quarter plate was about the size of one of the ordinary plates, and could be fitted into one of the regular measuring machines; but, of course, the squares of the réseau on it were just twice as broad as those on an ordinary plate. Hence the cross-scales in the eye-piece of the measuring machine (for description see *Monthly Notices*, vol. lv., p. 102), instead of each cutting *two* réseau-lines, could only each cut *one*. In the ordinary way we get with this machine two readings for each coordinate, say x_1 x_2 and y_1 y_2; such that the differences $x_1 - x_2$ and $y_1 - y_2$ are small, and indicate the correction for "runs" (*i.e.* want of equality between 100 div. of the scales and one réseau interval). With the paper chart we get either x_1 or x_2, but not both; and thus have no correction for runs, which is important in measuring a paper reproduction. Fortunately the squares were generally just a little smaller than the total length of the scale; so that the corrections for runs, although not obtainable incidentally in measuring the star, could be got from a separate operation by setting the four ends of the two scales just on réseau-lines. The corrections thus obtained were assumed to apply to the whole square, and the *single* measures of each coordinate were then corrected for runs. But it will be obvious that here we have sources of inaccuracy due to the method of measurement, and not to the charts themselves. Better methods of measurement could readily be devised; but in this preliminary investigation this method, ready to hand, was considered sufficient.

5. As the paper chart, with exposures of 30^m, contained more

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stars than the Oxford plate with exposures 6^m and 3^m, it was advisable to identify the stars to be measured on the former. From a few selected stars provisional linear formulæ were found connecting coordinates on one plate with those on the other; and the Oxford measures were then reduced, by use of these formulæ, to approximate accordance with the paper chart.

6. Measures were then made on the chart by setting the cross of the scale by estimation *in the centre of the triangle formed by the three images.* Here again is a probable inaccuracy, due merely to the method of measurement. By selecting one of the images, or better still, by measuring all three, the accuracy of the present measures could almost certainly be improved.

7. *Ninety* stars were then measured and compared. From *twenty* of these, four equations were formed in the ordinary way to find the exact linear formulæ connecting the two plates. The small corrections of the second order, due to the difference of centres of the plates, were at first neglected as probably representing too high an order of accuracy for this investigation; but were afterwards applied when it was found how accurate the measures were.

8. Applying the linear corrections found to the differences, the ninety residuals were found to be grouped as follows:—

Residual.		No. of cases. In x.	In y.	Residual.		No. of cases. In x.	In y.
	″				″		
+8 =	+2·4	1	0	0	0·0	10	17
+7 =	+2·1	0	1	−1 =	−0·3	19	10
+6 =	+1·8	0	2	−2 =	−0·6	12	9
+5 =	+1·5	3	5	−3 =	−0·9	11	5
+4 =	+1·2	5	4	−4 =	−1·2	4	4
+3 =	+0·9	5	10	−5 =	−1·5	4	3
+2 =	+0·6	4	12	−6 =	−1·8	0	1
+1 =	+0·3	12	8	−7 =	−2·1	0	1

Allowing for the two sources of inaccuracy above indicated, these differences show that the measures made on the paper chart are very nearly, if not quite, as good as the measures made on our Catalogue plates. The probable error of a single measure on the paper chart is not much greater than $0''\cdot3$, though in view of the provisional nature of the measures, it does not seem worth while to give an exact value to it.

It should further be remarked that the stars measured were of all sizes. The larger stars do not show the three images separated, but only a triangular patch; the charts are not meant to give the places of these with great accuracy.

9. In conclusion I would venture to add one remark with regard to the construction of these charts. If these indications of their accuracy are confirmed and extended by measures made under more favourable conditions at the French observatories,

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may it not be well to reconsider the practice of adding any finishing touches by hand? I gathered at the meeting of the Committee last July that a few touches are occasionally necessary—to insert stars accidentally omitted, &c. It seems improbable that these can be made with the accuracy which characterises the rest of the chart, and it might be well at least to indicate clearly in the margin where any artificial additions have been made. But I may have misunderstood what is done.

Observations of Phenomena of Jupiter's Satellites at Windsor, New South Wales, in the Years 1898 *and* 1899. By John Tebbutt.

Day of Obs.	Satellite.	Phenomenon.	Phase.	Mag. Power.	G.M.T. of Observation.			Mean Time of *Naut. Alm.*		
1898.					h	m	s	h	m	s
Mar. 29	I.	Tr. Egr.	Int. contact	168	23	7	43			
29	I.	,,	Bisection	,,	23	9	13	23	14	
29	I.	,,	Ext. contact	,,	23	13	37			
30	II.	,,	Int. contact	,,	22	5	54			
30	II.	,,	Bisection	,,	22	8	9	22	12	
30	II.	,,	Ext. contact	,,	22	12	18			
30	III.	Tr. Ingr.	Ext. contact	,,	23	11	18			
30	III.	,,	Bisection	,,	23	18	2	23	17	
30	III.	,,	Int. contact	,,	23	23	11			
Apr. 6	Shd. I.	Transit	On cent. merid.	74	0	7	0			
6	II.	Tr. Ingr.	Ext. contact	168	21	54	27			
6	II.	,,	Bisection	,,	21	57	11	21	56	
6	II.	,,	Int. contact	,,	21	59	46			
6	I.	Ecl. R.	First seen	74	22	23	59	22	24	13
13	I.	Occ. D.	First contact	168	21	37	37			
13	I.	,,	Bisection	,,	21	39	17	21	38	
13	I.	,,	Last seen	,,	21	40	56			
14	II.	Tr. Ingr.	Ext. contact	,,	0	8	57			
14	II.	,,	Bisection	,,	0	11	21	0	9	
14	II.	,,	Int. contact	,,	0	14	41			
14	I.	Ecl. R.	First seen	74	0	17	56	0	18	10
14	I.	,,	Full brightness	,,	0	21	30			
18	III.	,,	First seen	,,	0	18	42	0	19	19
18	III.	,,	Full brightness	,,	0	29	0			
May 30	I.	Tr. Egr.	Ext. contact	168	20	55	3	20	54	
30	III.	Ecl. D.	Began to fade	74	21	37	6			
30	III.	,,	Last seen	,,	21	47	28	21	42	0

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Day of Obs.	Satellite.	Phenomenon.	Phase.	Mag. Power.	G.M.T. of Observation.	Mean Time of *Naut. Alm.*
1899.					h m s	h m s
Apr. 21	III.	Tr. Ingr.	Ext. contact	168	22 53 42	
21	III.	,,	Bisection	,,	23 2 35	23 1
21	III.	,,	Int. contact	,,	23 11 29	
21	III.	Tr. Egr.	Int. contact	,,	23 48 32	
21	III.	,,	Bisection	,,	23 57 41	24 10
22	III.	,,	Ext. contact	,,	0 7 54	
23	II.	Ecl. D.	Began to fade	132	23 29 7	
23	II.	,,	Last seen	,,	23 32 17	23 32 10
May 2	I.	Occ. D.	First contact	230	23 3 4	
2	I.	,,	Bisection	,,	23 4 48	23 4
2	I.	,,	Last seen	,,	23 7 8	
3	I.	Tr. Egr.	Int. contact	,,	22 21 54	
3	I.	,,	Bisection	,,	22 23 59	22 26
3	I.	,,	Ext. contact	,,	22 26 58	
18	I.	Occ. D.	First contact	168	20 56 35	
18	I.	,,	Bisection	,,	20 59 25	20 59
18	I.	,,	Last seen	,,	21 1 24	
18	II.	Ecl. R.	First seen	74	22 53 35	22 55 44
18	II.	,,	Full brightness	,,	22 57 20	
18	I.	,,	First seen	,,	23 40 41	23 41 5
18	I.	,,	Full brightness	,,	23 43 47	
19	I.	Tr. Egr.	Int. contact	168	20 17 25	
19	I.	,,	Bisection	,,	20 20 20	20 23
19	I.	,,	Ext. contact	,,	20 23 39	
25	II.	Occ. D.	First contact	,,	21 48 30	
25	II.	,,	Bisection	,,	21 51 14	21 52
25	II.	,,	Last seen	,,	21 56 49	
25	I.	,,	First contact	,,	22 43 26	
25	I.	,,	Bisection	,,	22 45 30	22 44
25	I.	,,	Last seen	,,	22 47 5	
June 9	I.	Tr. Ingr.	Ext. contact	,,	23 29 28	
9	I.	,,	Bisection	,,	23 31 23	23 33
9	I.	,,	Int. contact	,,	23 33 47	
10	I.	Occ. D.	First contact	74	20 40 30	
10	I.	,,	Bisection	,,	20 44 10	20 45
10	I.	,,	Last seen	,,	20 46 34	
10	II.	Tr. Ingr.	Ext. contact	,,	21 0 37	
10	II.	,,	Bisection	,,	21 5 26	21 4

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Day of Obs.	Satellite.	Phenomenon.	Phase.	Mag. Power.	G.M.T. of Observation.	Mean Time of *Naut. Alm.*
1899.					h m s	h m s
June 10	II.	Tr. Ingr.	Int. contact	74	21 9 31	
10	III.	,,	Bisection	,,	22 20 34	22 21
10	III.	,,	Int. contact	,,	22 26 53	
10	II.	Tr. Egr.	Int. contact	,,	23 21 49	
10	II.	,,	Bisection	,,	23 25 18	23 23
10	II.	,,	Ext. contact	,,	23 30 47	
10	I.	Ecl. R.	First seen	,,	23 52 10	23 52 26
10	I.	,,	Full brightness	,,	23 54 43	
10	III.	Tr. Egr.	Int. contact	,,	23 55 53	
11	III.	,,	Bisection	,,	0 3 12	0 6
11	III.	,,	Ext. contact	,,	0 11 50	
July 26	I.	Occ. D.	First contact	70	20 49 22	
26	I.	,,	Bisection	,,	20 51 31	20 51
26	I.	,,	Last seen	,,	20 53 6	
27	I.	Ecl. R.	First seen	,,	0 17 28	0 17 27
27	I.	,,	Full brightness	,,	0 19 22	
28	II.	Occ. R.	Last contact		22 38 22	22 38
28	II.	Ecl. D.	Began to fade		22 49 20	
28	II.	,,	Last seen		22 54 24	22 53 16
Sept. 19	I.	Ecl. R.	First seen	70	21 6 46	21 6 59
19	I.	,,	Full brightness	,,	21 10 4	

Notes.

1898.

March 29.—Definition only occasionally good.

March 30.—Definition fairly good for Satellite II., and good for Satellite III.

April 6.—Transit of shadow estimated. Definition of II. pretty satisfactory; but the eclipse of I. was observed through cloud with full moon present.

April 13 and 14.—Sky beautifully clear; steadiness and definition pretty satisfactory throughout.

April 18.—Sky beautifully clear; images steady and well defined.

May 30.—Definition excellent and observation of contact unusually good. Sky clear and definition good at the eclipse. Satellite suspected five or six seconds later.

1899.

April 21 and 22.—Satellite visible throughout the transit as a bright disc. Definition was generally pretty good and occasionally very good. It was extremely difficult to fix the times of the phases in consequence of the oblique path of the satellite across the planet's limb.

April 23.—Definition pretty good, but Moon near her opposition and not far from planet.

May 2.—Definition pretty good, but last phase difficult to observe.

May 3.—Images tremulous and definition bad.

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1899.
May 18.—Definition pretty good throughout. The first phase of the eclipse of II. was observed rather late. The eclipse of I. was well observed. Sky beautifully clear, but Moon present.

May 19.—Definition bad and images tremulous.

May 25.—Definition pretty good.

June 9.—Definition bad and images tremulous.

June 10 and 11.—Definition bad and images tremulous; a higher power could not be employed.

July 26.—Definition good and images steady.

July 27.—Observation rather late, the satellite being rather conspicuous. The recorded minute was doubtful.

July 28.—Steadiness and definition satisfactory, but impossible to observe the final disappearance within five seconds. Clouds prevented an observation of the reappearance. This is, I believe, the third time a disappearance of the second satellite has been observed at Windsor after the planet's opposition, and the systematic observations taken here extend over a period of thirty-five years.

September 19.—Sky clear and definition pretty good, but Moon just risen.

An occulting bar was not employed in the observations. The times given are the Windsor mean times of observation diminished by 10 hrs. 3 mins. 20·5 secs., and entered to the nearest second. The observations of full brightness in the eclipses are at the best only rough approximations. In determining these times the increasing light of the satellite was repeatedly compared with the other visible satellites. The observations of July 28 were made with the $4\frac{1}{2}$-inch telescope, and all the others with the 8-inch instrument.

Observatory, Peninsula, Windsor, N. S. Wales:
1900 *August* 25.

Erratum in Monthly Notices, vol. lx.

P. 570, line 9 from top, *for* Approx. *read* Apparent.

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